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Assessment of extreme value distributions for maximum temperature in the Mediterranean area

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Extreme maximum temperatures highly affect the natural as well as the societal environment Heat stress has great effects on flora, fauna and humans and culminates in heat related morbidity and mortality. Agriculture and different industries are severely affected by extreme air temperatures. Even more under climate change conditions, it is necessary to detect potential hazards which arise from changes in the distributional parameters of extreme values, and this is especially relevant for the Mediterranean region which is characterized as a climate change hot spot. Therefore statistical approaches are developed to estimate these parameters with a focus on non-stationarities emerging in the relationship between regional climate variables and their large-scale predictors like sea level pressure, geopotential heights, atmospheric temperatures and relative humidity.

Gridded maximum temperature data from the daily E-OBS dataset (Haylock et al., 2008) with a spatial resolution of 0.25° x 0.25° from January 1950 until December 2012 are the predictands for the present analyses. A s-mode principal component analysis (PCA) has been performed in order to reduce data dimension and to retain different regions of similar maximum temperature variability. The grid box with the highest PC-loading represents the corresponding principal component. A central part of the analyses is the model development for temperature extremes under the use of extreme value statistics. A combined model is derived consisting of a Generalized Pareto Distribution (GPD) model and a quantile regression (QR) model which determines the GPD location parameters. The QR model as well as the scale parameters of the GPD model are conditioned by various large-scale predictor variables. In order to account for potential non-stationarities in the predictors-temperature relationships, a special calibration and validation scheme is applied, respectively. Haylock, M. R., N. Hofstra, A. M. G. Klein Tank, E. J. Klok, P. D. Jones, and M. New (2008), A European daily high-resolution gridded data set of surface temperature and precipitation for 1950 – 2006, J. Geophys. Res., 113, D20119, doi:10.1029/2008JD010201.